AP Statistics Test
Planning a Study
Instructor's Version

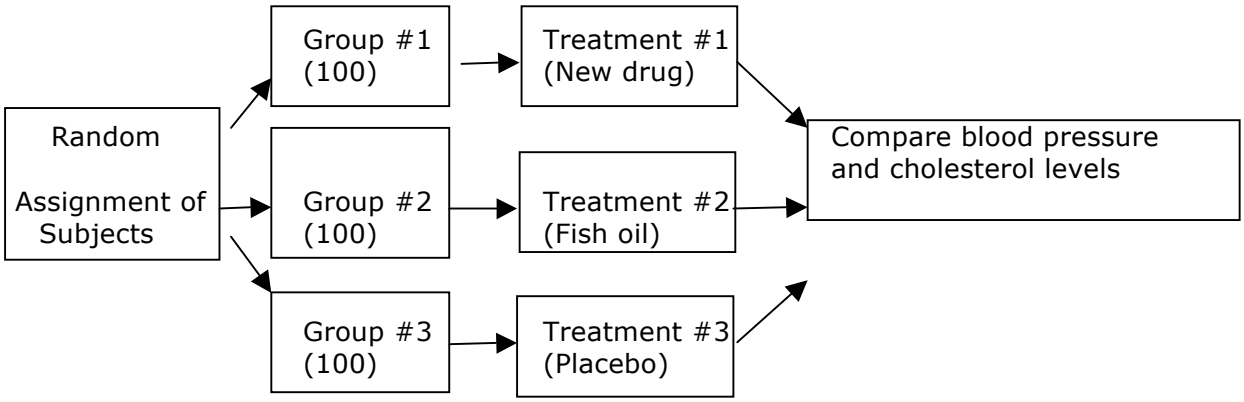
<u>Free Response</u>: 2 questions, 52 points, 30 minutes

1. Ace Pharmaceutical has developed a drug that it believes will help lower cholesterol and blood pressure at a significantly greater rate than fish oil. Researchers wish to test the new drug and compare the results to those of fish oil and of a placebo. A total of 300 volunteers suffering from hypertension and high cholesterol will participate in the study.

A. Explain how you would carry out this test in a completely randomized experiment. (12 points)

Answer: The answer can be in either diagram or paragraph form.

Diagram form:



Paragraph form: The 300 volunteers will be randomly assigned to one of the three treatment groups. The first 100 volunteers will go to the first treatment group and will receive the new drug, the second 100 volunteers will go to the second group and will receive fish oil, and the remaining 100 volunteers will go to the third group and will receive the placebo. Once the experiment is completed, blood pressure and cholesterol levels for the 300 volunteers will be measured and compared.

Scoring notes: To receive full points, the student must show a completely randomized design that includes the key features of random assignments to control groups, as well as measurement of the response variable.

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B. Explain carefully *how* you will ensure that the experiment is random. (6 points)

Answer: Each of the 300 volunteers will be given a number between 1 and 300. Using a random number generator (and ignoring repeated numbers), the volunteers with one of the first 100 numbers generated will go to the first group. The next 100 numbers generated will go to the second group, and the remaining 100 will go to the third group.

Scoring notes: Award full credit if the student supplies the correct method for randomly assigning the subjects to the treatments. The student must mention ignoring repeats in order to get full credit if they plan to use a random number generator. If this is not mentioned, but the method is correct, award 3 points. Student answers will vary if a different technique for randomization is used. Adjust scoring appropriately.

C. Explain how you could use blocking to modify the design from part A. Be sure to state why you chose the blocking method you did. (6 points)

Answer: Possible blocking schemes could be gender, age, or exercise vs. non-exercise. Any reasonable blocking scheme can be accepted as long as there is a valid justification for its use.

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2. Approximately 34 percent of U.S. households own at least one cat.

A. Using the random digit table provided below, explain how you would conduct a simulation to estimate the percentage of cat owners among U.S. households. Assume that you will look at 10 households at a time. (8 points)

95911 55241 74053 41002 18096 23370
19411 15586 98282 81306 73024 33198
03846 22199 73312 59593 05126 99863

Answer: A numbering scheme must be selected to correctly match digits to the 34 percent of U.S. households that own a cat. A correct scheme to represent the households with a cat could be 00-33 or 01-34. To represent those without a cat, a scheme could be 34-99 or 35-99,00.

Looking through the table two digits at a time, we see that each pair of digits represents one household, which either owns a cat or does not. Taking 10 pairs of digits and the number scheme above, it is possible to record the number of households with cats. Repeats will not be ignored.

Scoring notes:
- 2 points for a correct digit scheme
- 6 points for a correctly described method. Award 2 points for each of the following components of the method: what each pair of digits represents, what is being counted, and that repeats won't be ignored.

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B. Perform your simulation for 10 U.S. households. Run your simulation three times (in other words, run three trials). Make your procedure clear by marking directly on or above the table. State your conclusion. (8 points)

Answer: Student answers will vary somewhat, depending on the numbering scheme chosen and how they used the random digit table.

Using the scheme 00-33 to represent cat owners and using the first 10 digit pairs on each line gives 4, 6, and 4 out of 10 households owning cats (or 46.7 percent). Using the same numbering scheme, but continuing on a line after looking at 10 digit pairs, gives 4, 6, and 6 out of 10 households owning cats (or 53.3 percent).

Using the scheme 01-34 to represent cat owners and using the first 10 digit pairs on each line gives 5, 6, and 4 out of 10 households owning cats (or 50 percent).. Using the same scheme, but continuing on the same line, gives 5, 5, and 6 households owning cats (or 53.3 percent)..

Scoring notes:
- 6 points for a correct procedure clearly drawn on or above the random digit table
- 2 points for a correct conclusion

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3. Kim and Tracy are collecting data for their final project in their psychology class, in which they are conducting a survey about people's overall job satisfaction. They decide to go to the local mall to collect their data. To get a more varied sample, Kim surveys shoppers coming out of store A, a discount clothing store, while Tracy surveys shoppers coming out of store B, a high-end boutique.

A. Identify a possible problem with this type of sampling method. (6 points)

Answer: This is most likely a convenience sample. A common problem with convenience samples is that groups can easily be under-represented, resulting in a sample that is not representative of the population of interest. Therefore, the results are not likely to be accurate.

B. How might Kim and Tracy improve on their sample design so as to get more accurate information? (6 points)

Answer: There are several possible answers for this part of the question. The key is that probability must be used in the sample selection process. For example, Kim and Tracy may decide to randomly select a number of stores in the mall and interview all shoppers entering the stores over a certain time period. They could decide to stand at "neutral" places in the mall, such as the food court, the movie theater, and so on, and select a systematic random sample of mall visitors (e.g., randomly select the first shopper to interview, then interview every fifth or tenth shopper after that).

Scoring notes:
- Award full credit (6 points) as long as the design is realistic and incorporates probability in choosing the sample.

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